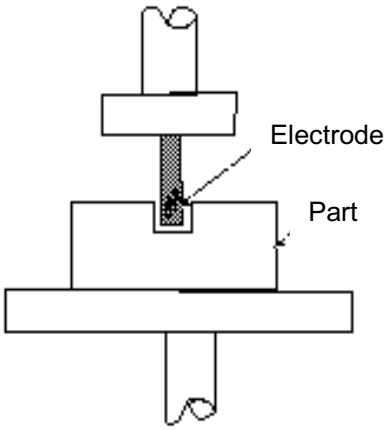
Applied Technology:
Electrical Discharge Machining (EDM)



Concept

Electrical Discharge Machining (EDM) is a technique used to cut complex shapes, particularly in very hard materials such as tool steels. Conventional EDM immerses the workpiece in a dielectric fluid, such as oil, and brings it close to a specially shaped tool. The tool is connected to DC, high voltage/frequency power. Millions of tiny electric arcs erode away microscopic bits of the workpiece, producing a hole which exactly matches the shape of the tool.

Wire EDM passes a very fine wire through a starter hole in the workpiece and cuts complex shapes as the workpiece is moved. The wire is continuously spooled, much like a bandsaw blade, to prevent it from breaking.

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Applications

- Cutting; dies, punches and molds
- Drilling; small micro-holes

Technologies Replaced

- Mechanical Milling, Cutting, and Drilling
- Laser Cutting and Drilling

Wastes Reduced

- Broken Cutting and Drilling Tools
- Scrap, Filings, and Swarf

Potential in Manufacturing

Indust	*SIC*	*Pot*	*Indust*	*SIC*	*Pot*	*Indust*	*SIC*	*Pot*	*Indust*	*SIC*	*Pot*	*Indust*	*SIC*	*Pot*
Food	20	LOW	Lumber	24	LOW	Chem	28	LOW	Stone	32	LOW	**Elect**	**36**	**HI**
Tobac	21	LOW	Furn	25	LOW	Petrol	29	LOW	Pmetal	33	LOW	**Transp**	**37**	**HI**
Textile	22	LOW	Paper	26	LOW	Rubber	30	LOW	MetFab	34	MED	Instr	38	MED
Apparel	23	LOW	Printing	27	LOW	Leather	31	LOW	**Mach**	**35**	**HI**	Misc	39	MED

Credits: Dr. Philip Schmidt and Dr. F.T. Sparrow;
Unimar Group, Ltd; The Electrification Council; Electric Power Research Institute

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Electrical Discharge Machining (EDM) ***continued***

Technology Advantages

- Non-Contact; handles delicate tasks
- Cuts or Drills Very Hard Material
- Highly Accurate; very small kerf (wire EDM)
- Produces Complex, Deep, or 3-D Shapes
- No Burrs

Technology Disadvantages

- Slow Cutting Rate
- Electrode Wear
- Thin Brittle Heat-Affected Zone

Typical Costs

Capital Costs	O & M Costs	Potential Payback
$100k - $200k depends on size, cutting rate, and controls	Low energy costs; maintenance are application and automation dependent	< 1 year or more

Installations

Case A - The auto industry used conventional drills for precise holes in fuel injector nozzles. Tolerance and accuracy were a problem. Annual replacement costs for drills was $180,000.

A switch was made to EDM. Typical drilling time is now 3 - 15 seconds per hole, and tolerances of better than 0.0025 mm (0.0001 “) are maintained on a hole diameter of 0.175 mm (0.0069 “). In addition to the high degree of repeatability, annual tool replacement costs were reduced to $2,000.

Case B - An aerospace fastener firm replaced their conventional manual process for producing special dies for custom orders with a wire EDM machine driven by CNC software. Time required to produce dies for prototype fasteners reduced from 40 hours to 4. Production die sets are now produced in 125 hours compared with 300 - 400 hours previously. This substantially reduces inventory requirements for special die sets.

Die quality and durability also improved since EDM parts are of more consistent dimensional tolerances and a harder steel can be used than was feasible with conventional production techniques.

Scrap rates reduced from 10 - 20% to less than 1%.

The company estimates its Payback period on the EDM system to be about 6 months.

Major Vendors

Electrical Discharge Machining (EDM)

Agie and Elox Corporation
565 Griffith Street
Davidson, NC 28036
(800) 438-5021

Easco-Sparcatron
10799 Plaza Drive
Whitmore Lake, MI 48189-9737
(800) 523-4443

Hansvedt Industries Inc.
803 Kettering Park
Urbana, IL 61801
(217) 384-5900

MC Machinery Systems, Inc.
Mitsubishi EDM Division
1500 Micheal Drive
Wood Dale, IL 60191
(708) 860-4210

This list of vendors of the indicated technology is not meant to be a complete or comprehensive listing. Mention of any product, process, service, or vendor in this publication is solely for educational purposes and should not be regarded as an endorsement by the authors or publishers.

Index to EPRI DOCUMENTS

Electrical Discharge Machining (EDM)

Electrical Discharge Machining, EPRI CMF TechCommentary, Vol 3, No 1, 1986

Electrical Discharge Machining, EPRI CMF TechApplication, Vol 1, No 9, 1987

This information is designed to help you determine **potential** applications for the technology. You are encouraged to contact one of the listed vendors or a consultant for details and pricing.

This manual is not intended as a recommendation of any particular technology, process, or method. Mention of trade names, vendors, or commercial products do not constitute endorsement or recommendation for use. It is offered for educational and informational purposes and is advisory only.

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